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Realistic Dynamic 3D Imaging of Core Plugs Using a Triaxial Cell

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We present a fully commissioned triaxial flow cell capable of simulating reservoir conditions while still maintaining X-ray transparency, which makes it ideal for in-situ CT experiments. The cell is designed to maintain up to 300 bars of pressure at a temperature of 90 °C and has been tested at reservoir conditions.

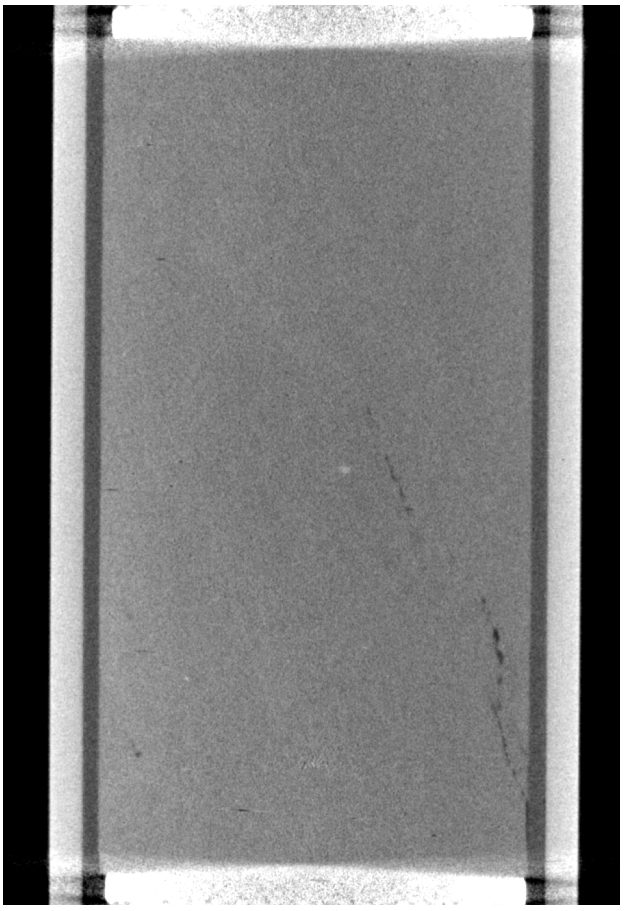

Figure 1: *A compacted chalk sample. Note the crack in the lower right corner.*

Performing CT in-situ experiments often entails decreasing scan time to capture the dynamic behaviour of interest, which reduces image quality. A special reconstruction algorithm developed for dynamic CT data is, therefore, employed to maintain image quality despite subpar data. The algorithm relies on prior information about the sample in order to constrain the reconstruction.

We demonstrate the performance of the triaxial cell through a single-phase flow experiment to verify our ability to capture dynamic behaviour. A chalk sample was saturated with simple saltwater and was afterwards injected with simple saltwater with a radiotracer. We were able to resolve the flow front of water that had a clear preferred direction in the chalk. The same chalk sample was used for a compaction experiment where we subjected the sample to 160 bars of triaxial pressure and imaged the cracks which formed in the sample.

The flow cell allows for the investigation of dynamic 3D phenomena that are relevant for research into CO_2 storage, abandonment and produced water management.

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